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Elementary Industrial School

Cleveland Public Schools

MATHEMATICS

The Board of Education
1912

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Elementary Industrial School

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MATHEMATICS

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The work in mathematics herein outlined is based upon three years' experience with classes in the Cleveland Elementary Industrial School.

Much of the work usually taught in higher grammar grades is touched upon lightly, or omitted altogether. Nothing is omitted, however, which has apparent practical value in the life of the pupil, and nothing that is essential to the study of the higher mathematics.

The value of abstract work in dealing with principles is conceded, but the aim is to make the work of practical value as a part of the daily life experience of the pupil. To this end concrete examples are particularly emphasized, and all possible material is drawn from the problems which the pupil meets in his occupational or other school work and in connection with his home and community life. To the teacher correlation thus becomes a vitally important element in class work. To the pupil knowledge becomes desirable because immediately necessary to success.

The work covers two years corresponding to the seventh and eighth grades of the elementary schools. The method used is partly Topical and partly Spiral. The correlation work demands the Spiral method, especially during the first year, and it is advisable because pupils are frequently entering the classes from the regular elementary schools.

The outline is the work of Miss Myrtle G. Campbell, instructor of mathematics in the Elementary Industrial School.

HARRIET L. KEELER,
Superintendent of Schools.

August, 1912.

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OUTLINE FOR TWO YEARS' WORK

I INTEGERS

(a) Roman Numerals and Arabic Characters

Brief History

Reading and writing of Roman Numerals from one to one hundred, and by hundreds to one thousand.

Suggestions for Application

Reading and writing of chapter numbers, dates, stone cuttings, etc.; enumerating; classifying.

(b) Arabic Notation and Numeration

Use of numbers through billions.

Suggestions for Application

Writing numbers as used on bank checks, etc.

Reading numbers which express commonly used astronomical distances. Geography

Suggestions for Correlation

Making of graphs showing products of the great industries, effects of inventions, etc.

Reading of official reports and newspaper articles, giving populations, municipal and national government expenses, year's agricultural crops, etc.

(c) Fundamental Processes and Principles

Horizontal addition of numbers less than one hundred.

Finding missing terms in multiplication as a foundation for the subject of Percentage.

Emphasizing practical short methods including cancellation.

Importance attached to checking.

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Suggestions for Application

Marketing and shop-keeping in the class-room, emphasizing the following subjects: Study of Prices; Making Change (using college currency); Need and Use of Sales Checks and Cash-books; Meaning of C. O. D., Charge, Debit, and Credit; Bills: Written, Discounted and Receipted.

Suggestions for Correlation

Use actual experiences received in the occupational work of the school in making payrolls, noting the time required.

Give emphasis to accuracy and neatness.

Use of Piece Labor Cards.

Stimulate just social relations between employer and employee.

(d) **Powers and Factors**

Review of the Multiplication Table and the powers and multiples selected.

Squares of numbers one to twenty-five memorized, and numbers twenty-five to one hundred squared mentally by algebraic formula.

Least Common Multiple and finding common denominators of fractions commonly used in correlation and in business.

Tests for factors.

Greatest Common Divisor.

Square Root as needed for mensuration and correlation problems.

Square Root by factoring method.

The square root of two and the square root of three memorized.

Cubes memorized from one to twelve, inclusive.

Suggestions for Application

Least Common Multiple as a common container compared with capacity of crates, packing boxes, cases, bins, etc.

Width of wall-paper may be a common divisor for walls.

(e) **Classification of Numbers**

Meaning and use of the class names: Integral; Fractional; Mixed; Odd and Even; Prime and Composite; Abstract and Concrete.

II FRACTIONS

(a) **Common Fractions**

Reductions and Principles.

Fundamental Processes.

Special emphasis put upon the three types of problems which make the foundation for Percentage.

Practical Aliquot Parts, especially sixths, eighths, and twelfths of one hundred.

Suggestions for Application

Drill in finding the price of one unit of measure when bought and sold, three, six, eight, or one dozen for one dollar.

Use short method for multiplication when aliquot parts are given as prices.

Find pitch of roofs, expressing heights as numerators and widths of houses as denominators.

Suggestions for Correlation

Give original problems suggested in shop work, using one-eighth, one-fourth and three-eighths of an inch for partitions and sides of boxes, trays, etc.

Allow one-fourth inch for finish and one-eighth inch for saw-curfs, in cutting material for class supplies.

Allowing for finish, find the total amount of lumber required for pieces of furniture when mill bills are given.

In sewing allow for waste in cutting out garments, and estimate the number of yards, pieces or bolts of material needed for supplying classes.

(b) **Decimal Fractions**

Compared with Common Fractions.
Notation and Numeration.
Reduction and Principles.
Fundamental Processes using three decimal places.

Suggestions for Application

Reading and writing numbers which express the velocity of light waves and sound waves.

Specific gravity.

Practical use of Average in finding the average depth, speed, temperature, rainfall, bushels per acre, dollars per capita, etc.

Given cost per yard to find value of three-eighths or five-eighths of a yard.

Use of the shilling.

Use of fractions in sales-checks, bills, payrolls and piece labor cards.

Suggestions for Correlation

Daily oral drill in fractions used in the occupational work of the school, and in practical business methods.

Division of given spaces into any number of equal parts as needed for design work.

Finding missing fractional addends as needed for putting dimensions on drawings.

Sawing lumber and cutting cloth into any number of equal parts to supply each pupil with one, two or more pieces.

Original problems made from the pupils' mechanical drawings.

III COMPOUND NUMBERS

The Compound Number Tables which are needed for buying and selling food, clothing, fuel, house furnishings, building materials and real estate.

Miscellaneous Table as needed for school and office supplies.

Table of Time and difference in dates.

Reduction of Compound Numbers.

Meter and liter compared with yard and quart.

Emphasis put upon the use of the yard stick and tape in measuring distances and determining areas and contents.

Fundamental Processes.

Suggestions for Application

Determining cost of excavating, roofing, painting, carpeting, laying walks, building fences, planting hedges and gardens.

Thermometer readings.

Problems in ventilation.

Finding contents of barrels, cisterns, storage bins and silos.

Suggestions for Correlation (Boys)

Emphasis put upon standard dimensions of lumber as given on Price List.

Over-all dimensions in shop problems estimated from given lumber bills.

Putting price marks on furniture.

Orders written for supplies from lumber mills, hardware stores, etc.

Original problems by the pupils.

Suggestions for Correlation (Girls)

Practice in the use of the scales and measures.

Comparison of weight and bulk of vegetables bought by the pound.

Tables used for recipes, memorized.

Multiplying and dividing amounts given in recipes in calculating the cost of meals for one or more persons.

Writing menus, cost being limited.

Determining amount of money saved when buying by the bolt, piece or bulk, or by doing ones' own sewing, cooking, laundering

Emphasis put upon standard widths of cloth.

Finding exact bias of the commonly used widths (Square Root).

Over-all dimensions in sewing problems, allowing for waste, shrinkage, ruffles, seams, tucks, hems, etc.

Orders written such as may be sent to clothing and furniture houses.

Original problems by the pupils.

IV UNITED STATES MONEY

Kinds of currency in daily use in United States.

Bank Checks, Travelers' Checks, Deposit Slips, Money Orders and Promissory Notes.

Suggestion for Application

Pupils will gain efficiency if allowed to establish a postal station and organize a bank in the class room.

Suggestions for Correlation

Household accounts kept by girls' classes, using items brought from home.

Girls taught to keep own personal accounts. Neatness, spelling and correct balancing emphasized.

Merchants' bills, electric and gas bills brought to class and compared.

Reading of meters.

Best way of making payments of water rents, taxes and insurance.

Pupils make original housekeepers' problems suggested by experiences at home.

V PERCENTAGE AND ITS APPLICATION

The three types of problems emphasized and traced through the following subjects using only practical cases:

Trade Discount, Commission, Profit and Loss, Simple Interest, Taxes, Customs and Duties, and Insurance.

Suggestions for Correlation

Commission and Profit and Loss emphasized in selling domestic science and manual training products.

VI RATIO

Compare terms with terms of a fraction.

Suggestion for Application

Use Building Code for original problems such as finding ratio of light surface to floor surface, rise of stairs to tread, pitch of roofs to wind pressure, etc.

VII PROPORTION AND THE EQUATION

The four axioms involving the four fundamental processes.

Show which signs are indicated by finding numerical value.

Suggestions for Application

Mixing of liquids, grains, fertilizers, etc.
Heights of building found by comparison of shadows.
Relative speeds of pulleys, shafts, and machines.
Supply and demand.
Raw material and finished products.
Proportion in Partnership.

Suggestion for Correlation

The equation is shown on a drawing for cabinet work; the height of a chair is equal to a total of the heights of the parts, and again these parts are divided to show joints and ornamentation.

Find missing fractional dimensions when totals are given.

Pupils test mill bills on their blue prints from drawing room.

From measurements taken in the shop estimate speeds of machines.

VIII MENSURATION AND CONSTRUCTION PROBLEMS

Erecting perpendiculars and drawing parallel lines.

Dividing lines into any number of equal parts.

Dividing of the circle into degrees.

Measuring angles.

Bisecting angles.

Constructing squares, rectangles, trapezoids, equilateral and right triangles, hexagons and circles. Find areas of same.

Compare perimeters of figures having equivalent areas.

Ratio of the perimeters of parallelograms having equivalent areas.

Inscribing square and hexagon within a circle and drawing tangents.

Surface of cylinder, cone and square pyramid.

Suggestions for Application

Finding areas of the four figures usually found in roofs, and exposed surfaces of cone-shaped or pyramid-shaped towers.

Practical use of the triangle in estimating heights and distances impossible to measure.

Suggestions for Correlation

Relate geometrical construction to shop problems, art work, making geographical charts, etc.

Models made in the shop to illustrate formulas.

Drawings and hand printed charts made to emphasize rules and principles.

Account book covers made in the art room.

GENERAL SUGGESTIONS

(a) When reading numbers use the word "and" to indicate the decimal point only.

(b) When possible indicate division in the form of a fraction in the planning of problems.

(c) Have pupils estimate results before solving.

(d) Occasionally have the steps of problems indicated without solving.

(e) Note that the quotient obtained in ratio is always abstract.

(f) When classes take their trips to municipal buildings, banks, factories and stores, have them use the information received in writing original problems. Such problems should be tested, solved and collected by the classes.

(g) Insist upon correct spelling and punctuation in all original problems, accounts and recipes.

(h) Give pupils approbation for questions which show careful thought.

(i) Help the pupil to see that what he is required to do is practical.

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